

DR. FRANK A. F. WINIBERG

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EDUCATION

Feb 2010 – Jan 2014 Ph.D in Physical Chemistry (Atmospheric Chemistry), University of Leeds.

Oct 2005 – Jul 2009 MChem. Int. (Hons) in Chemistry, Upper Second Class (2:1), University of Leeds.

RESEARCH EXPERIENCE

Mar 2020 – Present **Research Scientist, *Jet Propulsion Laboratory, Pasadena, CA.***

- Development of compact trace gas sensors based on frequency-modulated, tunable laser spectroscopy. The sensors detect carbon in water samples for life support systems on manned space flight missions.
- Development and implementation of spectroscopic laboratory apparatus for the study of chemical kinetics important to the atmospheres of Earth, Exoplanets and Planetary bodies.

Jul 2017 – Mar 2020 **Staff Scientist, *California Institute of Technology, Pasadena, CA.***

- Using Pulsed Laser Photolysis – Laser Induced Fluorescence (PLP-LIF) apparatus to investigate the reaction of OH + NO₂ and OH + NO over a range of temperatures and pressures important to the upper troposphere/lower stratosphere.
- Collaborating with Sandia National Laboratories and Caltech. Leading research effort into the kinetics and yield of β-hydroxy nitrates from the corresponding peroxy radical + NO using photoionisation mass spectrometry at the Advanced Light Source.
- Bimolecular reactions of Criegee intermediates in a joint collaboration with University of Pennsylvania, University of Bristol and Sandia National Laboratories. Contributed to the research direction, apparatus and method development for experiments at the Advanced Light Source.

Oct 2014 – Jul 2017 **NASA Postdoctoral Program, *Jet Propulsion Laboratory, Pasadena, CA.***

- Developed a unique Photolysis Induced Fluorescence (PIF) method of detecting nitric acid for use in chemical kinetic studies.
- Used the PLP-LIF apparatus, combined with the new PIF technique, to investigate the reaction of nitric acid with OH radicals over a range of pressures and temperatures.
- Collaborated with the Okumura group at Caltech. Helped run experiments using Mid-infrared Cavity Ringdown Spectroscopy, guided a graduate student and developed chemical kinetic simulation to aid data analysis in the investigation of nitric acid yields from the HO₂ + NO reaction.

Apr 2014 – Aug 2014 **Postdoctoral Researcher, *School of Chemistry, University of Leeds.***

- Characterised a chemical kinetics model for the product yields from the HO₂ + CH₃C(O)O₂ reaction.
- Trained PhD students and postdocs to use an atmospheric chamber and supporting instrumentation which I had developed during my PhD.

Feb 2010 – Jan 2014 **Ph.D, Prof. Paul Seakins and Prof. Dwayne Heard groups, *School of Chemistry, University of Leeds.***

- Developed a low pressure, Laser Induced Fluorescence based OH and HO₂ (HO_x) radical detection instrument for use in an atmospheric simulation chamber and validated the conventional calibration method using two new calibration techniques in the atmospheric simulation chamber.
- Implemented the instrument in the investigation of products from the reaction of HO₂ + CH₃C(O)O₂.
- Installed and characterised a new temperature control system for a ~2 m³ stainless steel simulation chamber, expanding the scope of future investigations.

Oct 2008 – May 2009 **MChem project, Prof. Paul Seakins group, *School of Chemistry, University of Leeds.***

PUBLICATIONS

In Preparation:

R. L. Caravan, T. Bannan, **F.A.F. Winiberg**, M. A. H. Khan, A. Rousso, A. Jasper, S. Klippenstein, S. Worrall, A. Bacak, P. Artaxo, J. Brito, S. P. Sander, J. Allan, H. Coe, D. L. Osborn, N. Hansen, D. E. Shallcross, C. A. Taatjes, and C. J. Percival, “*The role of Criegee Intermediate + ROOH reactions towards secondary organic aerosol formation – laboratory, modelling and field studies*” In Prep for Science.

L.A. Mertens, **F.A.F. Winiberg**, H.M. Allen, M. Okumura and S. P. Sander, “*Upper Limits on the Yields of HONO₂ and HOONO from the Reaction of HO₂ and NO with Pulsed Laser Photolysis and Mid-IR Cavity-Ringdown Spectroscopy*”, In prep for JPCA.

Selected:

K. Zuraski, F. Grieman, A. Hue, **F.A.F. Winiberg**, C.J. Percival, S.P. Sander, “*Kinetics of acetylperoxy radical reactions under pristine environment conditions: Insight from the direct detection of the hydroxyl radical.*” The Journal of Physical Chemistry A, 124, (40), DOI: 10.1021/acs.jpca.0c06220, 2020.

F.A.F. Winiberg, C. J. Percival, K. L. Zuraski, Y. Liu, S. P. Sander, “*Pressure and Temperature Dependences of Rate Constants for the Reaction OH + NO₂ + M → Products.*” The Journal of Physical Chemistry A, 124 (49), 10121-10131, DOI: 10.1021/acs.jpca.0c08920, 2020.

F.A.F. Winiberg, L. Christensen, M. Kale, A. Jones, C. Morrison, “*Miniature TOC Analyzer using Tunable Laser Spectroscopy and Combustion*” Proceedings of the 2020 International Conference on Environmental Systems, 2020-399, DOI:https://hdl.handle.net/2346/86263, 2020.

Vansco, M.F., R.L. Caravan, K. Zuraski, **F.A.F. Winiberg**, K. Au, N. Trongsirawat, et al., “*Experimental Evidence of Dioxole Unimolecular Decay Pathway for Isoprene-Derived Criegee Intermediates*”. The Journal of Physical Chemistry A, Vol. 124, No. 18, 2020.

R. L. Caravan, M. F. Vansco, K. Au, M. A. H. Khan, Y. L. Li, **F.A.F. Winiberg**, K. L. Zuraski, Y. H. Line, W. Chaoe, N. Trongsirawat, P. J. Walsh, D. L. Osborn, C. J. Percival, J. Jr-Min Lin., D. E. Shallcross, L. Sheps, S. J. Klippenstein, C. A. Taatjes & M. I. Lester., “*First Direct kinetic measurements and theoretical predictions of an isoprene-derived Criegee intermediate*” PNAS, 117 (18) 9733-9740, 2020.

F.A.F. Winiberg, C. J. Percival, S. P. Sander, “*Quantification of Nitric Acid Using Photolysis Induced Fluorescence for use in Chemical Kinetic Studies*”, Chem. Phys. Lett.:X, 3, 100029, doi: 0.1016/j.cpletx.2019.100029, 2019 (**Selected for Editors pick**).

F.A.F. Winiberg, C. J. Percival, R. Shannon, M. A. Khan, D. E. Shallcross, Y. Liu, S. P. Sander, “*Reaction Kinetics of OH + HNO₃ under conditions relevant to the Upper Troposphere/Lower Stratosphere.*” Phys. Chem. Chem. Phys., 20, 24652-24664, doi: 10.1039/C8CP04193H, 2018. (**Selected for Hot Topic of 2018**)

I. Bejan, **F. A. F. Winiberg**, N. Mortimer, D.J Medeiros, C. A. Brumby, S.C. Orr, J. Kelly and P. W. Seakins, “*Gas-phase Rate Coefficients for a Series of Alkyl Cyclohexanes with OH Radicals and Cl Atoms*”, Int J Chem Kinet. 2018;50:544–555. doi: 10.1002/kin.21179, 2018.

F.A.F. Winiberg, T. J. Dillon, S. C. Orr, C. B. M. Groß, I. Bejan, C. A. Brumby, M. J. Evans, S. C. Smith, D. E. Heard and P. W. Seakins, “*Direct measurements of OH and other product yields from the HO₂ + CH₃C(O)O₂ reaction*”, Atmos. Chem. Phys., 16, 4023-4042, doi:10.5194/acp-16-4023-2016, 2016.

F.A.F. Winiberg, S.C. Smith, I. Bejan, C.A. Brumby, T. Ingham, T.L. Malkin, S.C. Orr, D.E. Heard and P.W. Seakins, “*Pressure-dependent calibration of the OH and HO₂ channels of a FAGE HO_x instrument using the Highly Instrumented Reactor for Atmospheric Chemistry (HIRAC)*”, Atmos. Meas. Tech., 8, 523-540, 2015, doi:10.5194/amt-8-523-2015

Technical Reports:

T.J. Dillon, S.C. Orr, **F.A.F Winiberg**, I. Bejan, P.W. Seakins, Eurochamp2 project report, "*T & P-dependent product yields for reactions of HO₂ with isoprene-derived RO₂*", 2013, (http://www.eurochamp.org/icg-2/eurochamp_php_skripte/eurochamp/pdfs/E2-2013-05-15-0092_report.pdf).

M.T.B. Romero, **F.A.F. Winiberg**, L.N. Farrugia, S.C. Orr, A. Rickard, A. Munoz, P. Sanchez, X. Pang, A. Lewis, D.E. Heard, P.W. Seakins, Eurochamp2 project report "*A study of isoprene chemistry under low NO_x*", 2012, (http://www.eurochamp.org/icg-2/eurochamp_php_skripte/eurochamp/pdfs/E2-2012-04-09-0071_report.pdf).

T.J. Dillon, S.C. Smith, C.B.M Groß, **F.A.F Winiberg**, L.N. Farrugia, D.E. Heard, P.W. Seakins, Eurochamp2 project report "*OH regeneration in reactions of HO₂ with some important C₂ peroxy radicals*", 2010, (http://www.eurochamp.org/icg-2/eurochamp_php_skripte/eurochamp/pdfs/E2-2010-08-13-0042_report.pdf).

PRESENTATIONS

Invited Talks

F.A.F. Winiberg, C.J. Percival, R. Shannon, A. Khan, D. Shallcross, Y. Liu, S.P. Sander, "*Study of key OH + NO_x/NO_z reactions under upper troposphere/lower stratosphere conditions.*", oral presentation at the University of York, Dec 2018.

Conferences

F.A.F. Winiberg, A. Hui, K. Zuraski, M.D. Smarte, R.L. Caravan, G. Jones, J. Messinger, M. Okumura, D. Osborn, C.J. Percival, C. Taatjes, S.P. Sander., "*Effect of water complexation on the chemical kinetics of the β -hydroxyethylperoxy radical.*", poster presentation at the American Chemical Society Summer Meeting, Aug 2019, San Diego, CA.

F.A.F. Winiberg, A. Hui, K. Zuraski, M.D. Smarte, R.L. Caravan, G. Jones, J. Messinger, M. Okumura, D. Osborn, C.J. Percival, C. Taatjes, S.P. Sander., "*Does water complexation affect the reaction of the β -hydroxyethylperoxy radical with NO?*", oral presentation at the Atmospheric Chemical Mechanisms Conference, Dec 2018, Davis, CA.

F.A.F. Winiberg, C.J. Percival, R. Shannon, A. Khan, D. Shallcross, Y. Liu, S.P. Sander, "*Study of key OH + NO_x/NO_z reactions under upper troposphere/lower stratosphere conditions.*", oral presentation at the 25th International Symposium on Gas Kinetics and Related Phenomena, July 2018, Lille, France.

F.A.F. Winiberg, C.J. Percival, R. Shannon, A. Khan, D. Shallcross, Y. Liu, S. P. Sander, "*Rate Coefficient for OH Radical Reaction with HONO₂ at Low Temperatures.*", poster presentation at the American Geophysical Union Fall Meeting, December 2017, New Orleans LA.

F.A.F. Winiberg, Y. Liu, S.P. Sander, "*Rate Coefficient for OH Radical Reaction with HONO₂ at Low Temperatures.*", poster presentation at the American Geophysical Union Fall Meeting, December 2016, San Francisco CA.

F.A.F. Winiberg, Y. Liu, S.P. Sander, "*Rate Coefficient for OH Radical Reaction with HONO₂ at Low Temperatures.*", oral presentation at the 24th International Symposium on Gas Kinetics and Related Phenomena, July 2016, York, UK.

F.A.F. Winiberg, Y. Liu, S.P. Sander, "*Rate Coefficient for OH Radical Reaction with HONO₂ at Low Temperatures.*", poster presentation at the 63rd Pacific Conference for Spectroscopy and Dynamics, January 2016, Asilomar CA.

F.A.F. Winiberg, I. Bejan, C.A. Brumby, S.C. Smith, T. Malkin, L.N. Farrugia, T. Ingham, D.E. Heard, P.W. Seakins, "*Pressure and Temperature Dependence of OH and HO₂ Detection sensitivities for an LIF based*

FAGE instrument - a comparison of calibration methods.”, oral presentation at the American Geophysical Union Fall Meeting, December 2015, San Francisco CA.

F.A.F. Winiberg, T.J. Dillon, S.C. Smith, C.B.M Gross, S. Orr, T. Ingham, D.E. Heard, P.W. Seakins, “*Pressure and Temperature Dependent Product Study of the $\text{CH}_3\text{C}(\text{O})\text{O}_2 + \text{HO}_2$ Reaction using HIRAC*”, Oral presentation at the 8th International Conference of Chemical Kinetics, July 8 – 12, 2013, Sevilla, Spain.

F.A.F. Winiberg, T.J. Dillon, S.C. Smith, C.B.M Gross, S. Orr, T. Ingham, D.E. Heard, P.W. Seakins, “*Pressure and Temperature Dependent Product Study of the $\text{CH}_3\text{C}(\text{O})\text{O}_2 + \text{HO}_2$ Reaction using HIRAC*”, poster presentation at Atmospheric Chemical Mechanisms Meeting, December 10 – 13, 2012, Davis CA.

F.A.F. Winiberg, S.C. Smith, T. Malkin, L.N. Farrujia, T. Ingham, D.E. Heard, P.W. Seakins, “*Pressure Dependent OH and HO₂ Calibration of the Fluorescence Assay by Gas Expansion (FAGE) Instrument Using the Highly Instrumented Reactor for Atmospheric Chemistry (HIRAC)*”, poster presentation at the American Geophysical Union Fall Meeting, December 3 – 7 2012, San Francisco CA.

F.A.F. Winiberg, T.J. Dillon, S.C. Smith, C.B.M Gross, T. Ingham, D.E. Heard, P.W. Seakins, “*Preliminary results from the Product Study of $\text{CH}_3\text{C}(\text{O})\text{O}_2 + \text{HO}_2$ using HIRAC (the Highly Instrumented Reactor for Atmospheric Chemistry)*”, poster presentation at 22nd International Symposium on Gas Kinetics, June 18 – 22, 2012, Boulder CO.

F.A.F. Winiberg, S.C. Smith, T. Malkin, T. Ingham, D.E. Heard, P.W. Seakins, “*A New Pressure Dependent HO₂ Calibration Method for the Fluorescence Assay by Gas Expansion (FAGE) Instrument*”, poster presentation at 22nd International Symposium on Gas Kinetics, June 18 – 22, 2012, Boulder CO.